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WILL THE REAL BOSSES PLEASE STAND UP:

MARGLIN AND LANDES ON THE ORIGINS OF
CAPITALIST HEIRARCHY

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A long and provocative historical paper published in The Review of Radical Political Economy in 1974 raised once again a question of perennial interest to economists and historians alike - what accounts for the rise of the factory system? Stephen Marglin's 'What Do Bosses Do?' forced us to think once again about some of our fundamental assumptions about why our jobs, especially those in manufacturing, were organised in the way they were. He asked some traditional Marxist questions: 'Why did the actual producer lose control of production?' and 'What social function does capitalist hierarchy serve?' He argued there were two historical steps depicting the workers of control of product and process: (1) The minute division of labour which characterised putting out, (2) The development of the centralised organisation of the factory system. He argued further that these historical stages were neither inevitable nor technically superior to earlier or other alternative ways of organising work. Instead, they were innovations with a class bias; introduced not because they could produce more output for the same or fewer inputs, but because they could generate a surplus more easily captured by the capitalist class. Marglin thus challenged traditional assumptions on the economic advantages of the division of labour and the histories that had told us that new technologies and technical superiority accounted for the rise of the factory system. 'Bosses' context was propitious - a new widespread interest on the left in the critique of the factory and in workplace based struggles and grievances. But it has also survived its time. For though many of its propositions were familiar to readers of those classic chapters of Volume One of Capital, 'Manufactures' and 'Machines and Modern Industry', Marglin's presentation was also distinctive. He drew on

Marx, but without the Marxist hagiography he challenged some of the basic premises of modern economics. He claimed first that one of the factors of production, entrepreneurship, was unnecessary. And he argued secondly that work was structured as it was, in factories or highly subdivided operations, so that the capitalist could have a position and claim the surplus.¹ Marglin's case was built, furthermore, on a historical analysis of Britain's Industrial Revolution.

What was the response to this challenge? From the economists there was still the question that was put some years before by Samuelson. If the detail division of labour was the artificial creation of the capitalist, and the capitalist only a parasite, what then sustained capitalist production in free and open competition with other forms of enterprise? Why didn't the individual workman just set up shop for himself, producing for the market rather than the capitalist? By extension, there is his other formulation. 'Remember that in a perfectly competitive market, it doesn't matter who hires whom; so have labour hire capital.'² From the historians there was social history. They criticised Marglin's unintentional omission of workers' resistance and the continuity of class struggle over the generation and allocation of the surplus. Most of this response, furthermore, focussed on nineteenth and early twentieth century labour struggles.³ There was no response to Marglin's analysis and historical excursions into the rise of the putting out system and the factory system, except perhaps much tacit but unspecified disbelief.

At last, however, a historian has replied. David Landes,

whose Unbound Prometheus has provided both a great work and the major influential textbook of European economic history of the past twenty years in undoubtedly the 'man for the job'. His 'What Do Bosses Really Do' clarifies the stark differences between his own and Marglin's historical analysis. Landes concludes his critique by pointing out that the merit of Marglin's contribution was not the analysis of exploitation or utopianism, 'it was his attempt to study history and to enlist it in his argument'. And thus the reason for his intervention: 'it is the historian's job to respond. His primary task is to demythify the past and to prevent others from mythifying it, to come as close as possible to telling it like it was'.⁴ The way it was, according to Landes, was achievement of cost efficiency, that is, doing the job for less, using cheaper inputs, and thus underselling unspecialised manufacture.⁵ And the road to this achievement was organic specialisation through the division of labour and the technological momentum of machinery and the factory system. Landes gives us history led by technology in contrast to Marglin's historically contingent class forces shaping technology. Which of these approaches best tells us how it was?

A third approach not seriously considered by the others is the transactions cost approach. This approach did not credit the factory with productive efficiency, but did credit it with greater efficiency in the costs of transacting. Oliver Williamson argued that the hierarchially organised factory was better at quality control, reduced inventories, saved transport and allocated work more efficiently. The rationalisation of production within the factory enabled manufacturers to perceive where technological improvements

might be made, thus reducing costs of innovation. This approach has factors in common with Marglin's, namely that organisational rather than technological factors accounted for the transition to the factory system, but Williamson endows organisational efficiency with a neutrality in contrast to Marglin's class efficiency criterion.⁶

Other more specific historical responses to the technology, class efficiency and organisational efficiency analyses have focussed on testing the theories against one industry, as in Jones's recent analysis of the silk manufacture, or in breaking down the categories of analysis, as in the division created by Temin between entrepreneurs and managers.⁷

This paper will confine itself to discussion of Marglin's and Landes' opposing explanations of the division of labour, the putting out system, machines and factories and invention.

The Division of Labour

The first stage in Marglin's analysis of the origins of hierarchy in class rather than efficiency terms is a discussion of the division of labour. As we all know, Adam Smith set out the technical advantages of the division of labour as due to advantages in (1) increased dexterity, (2) saving time, (3) encouraging invention. Marglin sees the division of labour as reaching its epitome in the putting out system, the form of decentralised cottage manufacture and subcontracting prevailing in seventeenth to nineteenth-century Europe. Marglin dismisses the Smithian advantages of the division of labour

claiming instead that specialisation to component tasks was a means by which masters maintained control over knowledge, and the means by which the independent worker was transformed into wage labour.⁸

Landes rightly takes Marglin to task for his facile treatment of the division of Labour: set up costs did matter; repetitious labour may not have been very creative, but the repetition suggested to others imitation by machines of manual skills; and specialisation built on skill differences and improved dexterity within these.⁹

A much more comprehensive and considered critique of the economic as well as moral basis of the division of labour was mounted by John Stuart Mill in his defence of the small firm and artisan production of the Principles of Political Economy. Mill did not accept the time saving advantages Smith attributed to the division of labour, and claimed higher skill and higher productivity from artisans 'who perform a multiplicity of operations with a variety of tools.'¹⁰ Landes believes all three advantages mattered, particularly to cost efficiency, but gives special significance to dexterity and invention. He points out the significance of the division of the production process among gradation of skilled and unskilled workers. This was the contribution formulated by Charles Babbage in 1831, and elaborated both by Mill and Marx.

'that the master manufacturer by dividing the work to be executed into different processes, each requiring different degrees of skill or of force, can purchase exactly that precise quantity of both which is necessary for each process; whereas if the whole work were executed by one workman, that person must possess sufficient skill to perform the most difficult and

sufficient strength to perform the most laborious of the operations into which the art is divided.¹¹

The fundamentals of this analysis were common observation among eighteenth century political economists. Henry Martyn in his Considerations of the East India Trade in 1701 argued there should be a division of labour between more and less skilled trades, and within trades between more and less skilled processes. Less skilled labour would then be used more effectively in standardised processes and commodities. The extension of trades would, furthermore, rationalise the division of labour, and especially the division of skills among trades.¹² Dean Trucker also made the crucial point about the division between the skilled adult and unskilled child worker in the 1760's.

'In many provinces of the kingdom, particularly Staffordshire, Lancashire, and certain districts of Yorkshire, with the Towns of Manchester, Norwich and some others, the labour ... is very properly proportioned ... so that no Time shall be wasted in passing the goods to be manufactured from Hand to Hand, and that no unnecessary strength should be employed ... at Birmingham, viz. When a Man stamps on a metal Button by means of an Engine, a Child stands by him to place the button in readiness to receive the Stamp and to remove it when received, and then to place another. By these Means the Operator can stamp at least double the Number, than he could otherwise have done, had he been obliged to have stopped each Time to have shifted the Buttons: And as his Gettings may be from 14d to 18d and the Child's from a Penny to 2d per day for doing the same Quantity of Work, which must have required double the Sum, had the Man alone been employed; this single Circumstance saved alone 80, or even 100 per cent, at the Same Time that it trains up Children to an Habit of Industry, almost as soon as they can speak.¹³

The division of labour thus allowed a cost effective use of degrees of skill. But skill itself needs to be dissected. Women's

and children's labour was used because, for historical reasons, it was cheap. But cheapness often masked other attributes which contributed to productivity gains.

Tucker's statement highlighted the special role of child labour in eighteenth century manufacture. Marglin, like many Marxist historians of the labour process, misses the major reason for employing children's and women's labour so extensively in the putting out and workshop trades. For this labour was not only cheap; it was a bargain. It was called unskilled, but it did have special attributes which went unpaid. These attributes were technical and social; manual dexterity and the dynamic of the adult-child work group. Here Landes is right when he cites Robert Southey on what he called on the 'unnatural dexterity with which the fingers of these little creatures were playing in the machinery.'¹⁴ Whether this manual dexterity was due to natural attributes such as size of hands and fingers and developmental phases of fine motor skills and concentration, or whether it was caused by childhood socialisation in needlecraft is still a question of research. But children certainly had more to offer than their cheapness. The manual dexterity of children and young girls in workshop trades was sought out not just in the eighteenth century but in the nineteenth. In nineteenth century Birmingham, one overseer of a press shop argued the women could not do without the girls. "The girls came at 9, but are not so nimble as if they came at 7."¹⁵ Similar manual dexterity was valued in the painting section of the pottery trades, notably by Wedgwood, and the picotage and pencilling stages of the calico printing industry.¹⁶ The adult-child work group saved on labour costs by drawing on workers'

own kin and friendship networks to reduce costs of labour recruitment, and by using this as an effective internal system of management discipline and training. This use of child assistants, furthermore, allowed a greater intensity of labour, along with a means of smoothing bottlenecks in the production process. In the silk manufacture, girls were 'taken on so young because their fingers are supple and they learn the skills more easily.' In the cotton industry the size of children's hands was often cited as important in piecing operations.¹⁸

Developing this special dexterity and organising manufacture into the typical work group of adult and child assistant made vital contributions to productivity advances based on the division of labour in the eighteenth century. Landes thus uses Babbage to the point when he defines entrepreneurship as the ability of capitalists to break down the product into a number of simple tasks and assign them to workers of different degrees of skill and experience.

The Putting Out System

Where the division of labour really made its mark historically was not in the large scale workshop modelled in Marx's 'phase of manufactures', but in the putting out system, an organisational innovation which took production away from urban workshops to a potent combination of merchants and decentralised rural outworkers. Marglin argues that this crucial specialisation of function between merchants and producers, and not the factories and machines which came later, was responsible for the emergence of industrial wage labour. He argued that the master manufacturer confined to himself crucial knowledge in the buying of material and

marketing of products, and insured the dependence of outworkers through debt and wage advances.¹⁹ Though Marglin does not explain it, this dependence of outworkers was caused by differences in access to credit. The master manufacturer could control the outworkers' product markets by monopolising credit markets. This is an aspect of the putting out system which has received minimal analysis. One historian has put it that 'putting out was necessarily a form of credit, though historians have often treated it loosely as a kind of wage labour'. Outworkers who had the nominal independence to seek out alternative sources of raw materials and other outlets for their product were frequently bound in debt to one master manufacturer. As T.S. Ashton put it,

'In other industries payment in truck or the new discipline must be given first place among the ills afflicting the wage earner, in the metal working trades indebtedness to the employer would seem to have been far the most serious barrier to the attainment of economic liberty.'²⁰

This debt peonage was not always, however, so inflexible, nor was it a new feature of the local economy associated with putting out. In the artisan trades of eighteenth century France, credit and debt accommodation among masters and journeymen were a part of the bargaining process at least as significant as the wage. In eighteenth century England, there were long tradition of neighbourhood credit and indebtedness among the middling to lower classes so that the master manufacturer had only to adapt to his own advantage a long standing community practice.²¹

It is over the putting out system that Landes really starts

to consolidate his differences with Marglin. Marglin's putting out system is clearly extremely simplistic. It is a system where a formerly independent worker was placed in thrall to a single putter outer, and bound to him through specialisation and debt. Landes' alternative is just as simplistic. On the example of the clock and watch trade, he claims that workers specialised, and out of this specialisation the most enterprising emerged as merchant manufacturers. In Eastern Europe serfdom, and in the seventeenth and eighteenth century cotton and hosiery industry, middlemen putter outers appeared, and hierarchy was only a form of intermediation.²²

Which reality was more general? Probably neither. There was certainly the Jimmy Squeezum figure that Landes describes so well in The Unbound Prometheus,²³ and which Marglin uses for his entire image of putting out. He was ubiquitous in late eighteenth and early nineteenth-century framework knitting, the nineteenth century handloom weaving and the eighteenth century West Country woollen industries. And we don't have to wait until the eighteenth century to find such figures. The nail workers of the West Midlands in 1655 described the ironmongers who ran their lives as 'Egyptian Taskmasters'.²⁴ But there were also the putting out systems found in the mid eighteenth century Lancashire cotton industry. Here competitive markets and new opportunities made the early fustian masters and small factors more akin to village milkmen dealing with a number of cottage entrepreneurs. Indeed, some of these factors might rise to considerable prominence. Samuel Bamford remembered the rise of a merchant manufacturer named Hulme, who started with a small dye at Belmont near Bolton. He first came round with a one horse cart collecting calicoes, and 'as he was

steady and industrious' he got on fast. He then appeared with a cart and two horses, then a wagon, and in a short time as many wagons as his business required.²⁵

Marglin's Jimmy Squeezum is, to be sure, only one extreme of the putting out system. But Landes's organic specialist gives us no more balanced a view. We can account for the rise of the merchant manufacturer, as he pretends, by the example of the small producer made good in the clock and watch manufacture. His example is particularly evocative in small scale, workshop based, skill intensive industries like clock and watch making and most small metal wares. I do not dispute Landes's portrayal of the unity at one time of worker and capitalist in the watch trade. (Though this must have been uncommon by the seventeenth century in England as least, where we see the putting out of the manufacture of watch movements and tools to highly subdivided rural workers in south west Lancashire by all the big firms in London, Coventry and Liverpool).²⁶

In other areas where there was a less highly organised putting out system and where there were few status divisions based on old guild traditions, producers passed in and out of the independence and outworker status. The journeyman in the Sheffield trades might be outworker or pieceworker, but he had his own tools and forge. The small master in the Birmingham trades was independent, though he might be working pretty regularly for a particular factor. And masters worked regularly on the premises of Crawley's works at Winlanton. In this scenario, who was master, who was artisan; who was the factor and who was the dependent outworker? Conditions of independence,

therefore, varied across industries, and in particular varied with economic fluctuations. There clearly came a time, however, though not until well into the nineteenth century, when most of this independence was severely constrained by the control of merchant capitalists or of a large scale manufacturing sector.

Marglin's identity of the putting out system with extreme specialisation and his association of the system with the organic development of specialisation both miss the point that the putting out system only took form and meaning within specific economic and social contexts. The putting out system as a form of work does not tell us very much outside the context of the degree of market power exerted in some regions or industries over sources of supply and outlets of trade by an elite of manufacturers. The extent of market power of competition is not in turn explained by the contrived needs of capitalist hierarchy, nor by the inherent drive to specialisation. This power could only be exerted under specific conditions of labour supply. Where labour supply was restricted, outworkers and artisans were in a much stronger position, and it was accordingly difficult for any small group of large scale manufacturers to gain a dominant position. The sources of dispersed or concentrated control over raw material and product markets lay, therefore, in the conditions of labour supply.

The supply of labour might be limited by demographic factors, by communal agrarian institutions restricting enclosure and squatting, or by urban corporations. And where labour supply was restricted, this did not necessarily entail different organisational

forms. Conditions of work within these forms could, however, be more favourable to the workforce. A labour supply restricted by agrarian arrangements supported the artisan structures of the West Riding of Yorkshire well into the nineteenth century, and urban corporate traditions supported the artisan base of the Coventry ribbon weaving and watch making trades. The flooded labour markets of the East Midlands, however, supported a highly exploitative putting out system in the framework knitting industry. The early Lancashire cotton industry was also organised on a putting out system from the outset, but a more restricted labour force exercised a degree of control over market and middlemen. The significance and outcome of the putting out system or proto-industrialisation was not a foregone conclusion which could be found in seeing it simply as an innovation in capitalist organisation. It might become the root of an innovative factory sector or alternatively an artisan sector. But equally possible results were sweating and the flooded labour markets of the burgeoning eighteenth century service sector.²⁷ Yet the road down which Landes and Marglin lead us passes only from putting out to the factory system.

Factories and Machines

If Marglin and Landes differ so strongly on the origins and effects of the division of labour and specialisation, their analyses of the rise of the factory are even more divided. Marglin argues that economic historians have traditionally ascribed the rise of the factory to advances in technology, treating problems of labour discipline and supervision as secondary considerations. He dismissed

both the assumption that factories appeared because they were technically more efficient. The putting out system was very successful and very cheap to run, but it did ultimately face problems of labour discipline and embezzlement.

'The agglomeration of workers into factories was a natural outgrowth of the putting out system (a result if you will, of its internal contradiction) whose success had little or nothing to do with the technological superiority of large scale machinery. The key to the success of the factory, as well as its inspiration, was the substitution of capitalists' for workers' control of the production process; discipline and supervision could and did reduce costs without being technologically superior.'²⁹

This has been perhaps the most contentious part of Marglin's case. And it is interesting that Marglin here departs from classical Marxist historiography, and sees the key move as one from the division of labour and the putting out system to the factory, rather than the move to machinery and modern industry. The implications for his case are important.

Landes takes up the opposite position to this one. He does concede part of Marglin's explanation for the rise of the factory, that is, as a means of gaining control over the work process. Indeed, Marglin took much of his argument here from Landes's Unbound Prometheus. But Landes argues that this was not enough ... 'the factory was not just a big workshop -- it used power driven machines'³⁰, and what made the factory successful was the machines. Marglin produces several well known examples of similar techniques used in cottages and factories (jenny spinning, hand loom weaving, filemaking) with the equally well known observations that factories

enhanced labour discipline, helped to control embezzlement and were a better insurance for the protection of patent rights. These were all factors which enhanced profitability to the capitalist without necessarily enhanced efficiency. When and how much the worker would exert himself remained with the worker until the factory system - the factory broke this workers' control over the production process.

But with this analysis, Marglin remains entrenched within the realm of ways of organising the labour, leaving unchallenged the implications of machine production. His focus on discipline is about control over the time and intensity of human labour, and this control is simply shifted with the rise of the factory from one human agency to another - from direct producer to factory owner. Marx looked instead at the significance of the move to machine production. This was the 'really revolutionary change', for it overcame previous human limitations on increasing the surplus imposed by the length of the working day, providing instead for limitless increases in productivity. The machine was also an independent mechanical means of control over the workforce. Whereas in the phase of manufactures, capital 'is constantly compelled to wrestle with the insubordination of the workers', the machine and modern industry was 'the most powerful weapon for suppressing strikes'. It was the 'objective basis for the intensification of labour, and for the emergence of the 'barrack like discipline of the factory'.³¹ The road to the system of automatic machinery was based on the division of labour.

'This road is, rather, dissection ... through the division of labour, which gradually transforms the workers' operations into more and more mechanical ones, so that at a certain point a mechanism can step into their places ... thus, the specific mode

of working here appears directly as becoming transferred from the worker to capital in the form of the machine, and his own labour capacity devalued thereby. Hence the workers' struggle against machinery. What was the living workers' activity becomes the activity of the machine.³²

It was the machine, not the factory system which was the crucial threat to workers' control within the labour process, as workers, industrial pundits and political economists in the nineteenth century were well aware.³³ And it is the machine that Marglin refuses to consider seriously in 'the Bosses'. This is largely because he fails to penetrate the class relations within technological change. He focusses instead on the factory, leaving technology as an outside force, which simply enhanced the capitalist's contrived position within the labour process. In effect, Marglin accepts the neutrality of technology and on this, his perceptions are really not all that different from Landes's.

For Landes, technological change really was the impetus. Dispersed cottage manufacture, despite its problems of labour control, was highly successful. In Landes's words, 'what made the factory successful in Britain was not the wish, but the muscle: the machines and the engines. We do not have the factories until these were available, because nothing less would have overcome the cost advantages of dispersed manufacture'.³⁴ And Landes's technology is indeed something to be reckoned with. The title of his great work, The Unbound Prometheus, was absolutely true to his vision - a vision unashamedly apocalyptic. Technology marched forward, fulfilling its pre-ordained logic in overcoming all previous production barriers. The achievements of new machinery, new power sources and new raw

materials were part of a single movement. Technological momentum was a power in and of itself.

Landes' analysis of technological advance in this critique of Marglin gives clear dimensions to the beast. He argues the new machines were irresistible. Had the forced labour used initially to work them not been available, the 'mills would have found some, paid the price and still made money because the carding machine, water frame and mule were so efficient compared to hand labour'. And technology advanced, 'not like a feedback robot', changing course at every obstacle - it typically takes the form of a series of probes, feeling out a particular line, improving on previous failures'. The 'nature of techniques was dictated by the character of known devices - technology has its own preferences'.³⁵

The power of the machine dominates Landes's history of innovation in the textile industry. He tells us there was virtually no resistance to the early textile innovations. The superiority, it seems, was so patently obvious that resistance was pointless. Landes tells us, 'by the 1760s fears over technological unemployment were irrelevant ... they were not raised against Richard Arkwright, inventor of the water frame ... the introduction of the jenny (1767) was not initially a threat to domestic spinning ... it increased output in the cottages and ushered in a 10 year period of hectic prosperity ... the water frame was powered from the start and used in factories'.³⁶

Let me now deal with these statements which convey the

standard perspectives of economic historians on resistance to machinery. It is first clear that Landes's statements as put here are an incomplete version of the truth. Hargreaves' first spinning jenny was destroyed by a mob in 1767, prompting his move (along with the woman who operated and repaired his jennies) to Nottingham. In 1769 more of his machines were destroyed at Turton, Bolton and Bury.³⁷ There were major riots in 1779 directed against the 'patent machines' of Arkwright and the larger jennies. The mob attacked ten factories. The largest was Birkacre, an Arkwright mill; Arkwright was one of the partners. This mill was effectively destroyed, and Arkwright in turn was so alarmed that he put his mill at Cromford into a state of seige. A letter written from Cromford described the preparations.

'In your last letter you expressed some Fear of the Mob coming to Destroy the Works of Cromford, but they are well prepared to receive them should they come there. All the Gentlemen in this Neighbourhood being determind to support Mr. Arkwright, in the defence of his Works, which have been of such Utility to this Country, Fifteen hundred Stand of small Arms are already collected from Derby and the Neighbouring Towns, and a great Battery of Cannon raised of 9 and 12 Pounders, with great plenty of Powder and Grape Shot, besides which, upwards of 500 Spears are fixed in Poles of between 2 and 3 Yards long. The Spears and Battery are always to be kept in Repair for the Defence of the Works and Protection of the Village, and 5 or 6000 Men, Miners etc. can at any Time be assembled in less than an Hour, by Signals agreed upon, who are determind to defend to the very last Extremity, the Works, by which many Hundreds of their Wives and Children get a decent and comfortable Livelihood ...' ³⁸

Landes's view that Arkwright moved to Nottingham in 1768 where he found capital, labour and a friendly environment where there was no local opposition to the introduction of machines, is also

something of an embroidery on the real situation. Stanley Chapman, on whose work Landes relies yet again, himself tells us that the labour force in Nottingham was well known for riot over wages, market prices and religious prejudice. Nor were attacks on new machines unknown. Indeed Arkwright's own mill in Nottingham was the subject of an attack by stockings in 1779 when their bill for fixing wages was thrown out by Parliament. The attraction of Nottingham had more to do with its wealthy merchant class, and their well known patronage of inventors.³⁹

There was, it seems, initially a difference in attitude to the water frame and the jenny. In the words of a contemporary petition,

'that the jennies are in the Hands of the Poor, and the patent machines (i.e. water frames) are generally in the hands of the rich; and that the work is better executed by small jennies than by large ones.'⁴⁰

'In the Hands of the rich' epitomises the water frame. Landes's statement that the water frame was powered from the start and used in factories needs to be put beside other contemporary evidence about the machine and its inventor. The patent water frame of 1769 was built on a small scale and was turned by a handle. A replica in the Science Museum of London

'Spins beautifully and shows that the water frame could have been built in small units, placed in cottages and turned by hand. In other words, it could have been used like the jenny as a domestic spinning machine. One member of the Arkwright's partnership, I suspect it was Arkwright himself, for it seems in character, must have realised that if this had happened they would have lost control of the patent, for everyone would have copied it and built their own machine in the privacy of their own homes. By restricting the licences to units

of a thousand spindles, it became economic only when they were erected in a water-powered mill. This was a vital decision in the development of the textile industry and of the Industrial Revolution which never seems to have been recognised before.⁴¹

It was the machine that thus became identified with the mill. Arkwright's patent was not overthrown until 1785, by which time production using the technique was not conceived of on a smaller scale.

But what of the spinning jenny? Marglin was much inspired by the example of the jenny which was used in cottages as well as jenny factories until factory spinning took over the nineteenth century. The position of the jenny needs elaboration beyond Landes' bald statement that it was not initially a threat to domestic spinning. The jenny, though built and used by Hargreaves in a factory in Nottingham, spread first in Lancashire as a cottage technology, a machine of 12 to 16 spindles. It was taken up by hundreds of imitators, developing 'like a folk song passing from one artist to another, so that authorship was an inappropriate concept'. It was a technique of the cottage entrepreneur, a woman's technology. It was hailed as a prodigy in one district; 'every weaver learned to spin on the jenny, every clothier had one or more in his house, and also kept a number of women spinning year for him in their cottages.'⁴² Indeed the beneficiaries of the jenny in its first ten years were the outworkers - but only some of the outworkers. For the jenny, in spite of advantages to cottagers in textile regions, had a devastating effect on families in declining agricultural regions, where women's and children's hand spinning helped the rural poor to eke out a living.

The jenny was one of those machines which 'drove these districts into industrial oblivion' and rural pauperism.⁴³ To be sure, the jenny had a history of resistance in the cotton industry, especially after the emergence of the large jenny in the so-called jenny factories. But its introduction in the much larger eighteenth century woollen industry was subject to very widespread resistance, particularly in the West Country.⁴⁴ The voice of the displaced hand spinners in cotton as well as wool was expressed in 1780 by Ralph Mather.

'These (Arkwright) Machines at the time of their first erection were not so detrimental to the laborious manufacturer, because one or two only of them was then built, and trade at the time every day increasing, and the Cotton exportations very large.

But since the year 1774 our exportations having very considerably abated, and the demands in the Cotton branch not being half so great, together with the rapid increase of the number of these Machines, which require so few hands, and those only children, with the assistance of an overlooker ... and performing as much work as would ... employ ten grown up persons ... and also other inventions, to wit, Jennies for spinning with one hundred or two hundred spindles ... and requiring but one person to manage them: (one of which spindles was the old and usual instrument by which every poor women obtained her bread) and likewise Doubling, Twisting, and Winding Mills ... and these Engines (mills or Machines) not being under the description of the Patent Machines ... has caused them to increase with such rapidity, that many are built in every town, village, and hamlet in Lancashire, and the surrounding counties.'⁴⁸

The jenny was clearly the major innovation to be reckoned with in the eighteenth century textile industry, and its context of carding and twisting machines, along with its design made larger scale factory versions an obvious development. But cultural and social framework were crucial to this development. If the new techniques

were clearly so efficient, why were they only slowly introduced in the textile industries of England's rivals, especially France? William Reddy presents the dilemma. The design of the jenny was a design for large scale production. It simply imitated and multiplied the actions of the spinner's hand. 'Nothing could have demonstrated more graphically the potential fecundity of cost cutting in production. Instead of one human hand working, there were 60 wooden ones, yet the expenditure of human effort was nearly the same. This much was easy to see by looking at it'. But the design of the machine as such was also a 'design for social change'. Seeing the potential productivity of the machine involved seeing the revolution in the social organisation of production it entailed. If the machine was so superior, why on the eve of the Revolution did England have 20,000 jennies, 9,000 mule jennies and 200 Arkwright type mills, while France had less than 900 jennies, most built in government factories, only eight water frame mills and no mules?⁴⁶

Factories and Invention

Marglin argues that technical change was not an independent cause of the factory, and furthermore, that the forms which technical change took were shaped and determined by factory organisation. The role of the factory system in determining the shape and direction of technical change was carried out through controls exerted on invention. On the demand side, capital provided the market for inventions and improvements, and the capitalists' interests lay with the factory. On the supply side, it was difficult to enforce patent rights if production was dispersed, and the patent system played into the hands

of the more powerful capitalists by favouring those with sufficient resources to pay for licences.⁴⁷

Landes quite rightly points out that patents were not all that important as incentives to invention. The clock and watch manufacture was very creative without many patents. The hardware and toy trades of Birmingham were also very creative with and without patents. Birmingham's decentralised production processes did not prevent it holding more patents to its credit until the 1850s than any where outside London. In spite of small scale manufacture, the cost of obtaining patents was raised for small improvements in the manufacture of trinkets and buttons, in machine tools, metal composition and scientific instruments. But, as in much British manufacture, many improvements were never patented - they were adopted by 'secretive manufacturers who locked their doors, and found it easier to withhold their innovations by keeping them dark'.⁴⁸ Patents were frequently useless to inventors - their improvements were not infrequently 'discovered' by other richer manufacturers who quickly usurped them before patenting was possible. Hargreaves' experience with Robert Peel is a good illustration. Hargreaves' was one of Peels' outworkers in 1764 when he produced his first jenny. The putting out system did not prevent Peel detecting an improvement in quantity and quality of yarn from the Hargreaves household. Peel found some means of persuading Hargreaves to give way, and reveal the source of his increased productivity. He then insisted on making the invention public, and offered Hargreaves and his sons employment at his new print works. We all know the great rise to fortune of the Peel family, but Hargreaves never prospered, and died a disappointed

man.⁴⁹ Even the proud and the powerful found it difficult to make patents do their job. Arkwright could not stop his imitators, and the particularly litigious Boulton and Watt pursued with a vengeance imitators not just of their own steam engine, but of coining presses, alloys and other improvements. Their size did not make them any more successful in this game. Landes is right, then, to point out that 'the greater share of productivity increases in factory manufacture was the result of the accumulation of small unpatentable improvements'.

But is he right to then claim a factory bias to technological change? Landes's reasons are these: (1) that was where the money was; (2) the saving in labour costs was higher because factory wages were higher; (3) the accumulation of small improvements was a function of the volume of investment - the new plant meant new and better equipment; (4) the factory environment was a more favourable environment for the perception of improvements, and the entrepreneur was in the best position to see the needs and opportunities of technological change. Landes concludes with the inevitable - 'the logic of technology was moving towards even wider mechanisation, toward doing more and faster, thereby enhancing the advantage of mass production and the factory system.'⁵⁰ If the factory was the logical outcome, every other possible path of development can be written off by Landes as fantastic, utopian or irrational.

Landes's criticisms make clear his differences with Marglin over the place of entrepreneurship and the capitalists, and his

assessment of the alternative lying behind Marglin's analysis. They are at opposite poles of the political spectrum on the capitalist (though it might be added that Adam Smith agreed with Marglin, while Marx like Landes was well aware that what really mattered was that the capitalists were in it for the money). But must the factory bias of technological change follow? An answer to this must lie in the nature of the alternative. Behind Marglin's case lies his belief in the possibility of small scale industry, non-hierarchical production, non-specialised work, collective goals. Landes dismisses this as dreams, and doesn't think there were any real alternatives. In his view, technical choices were not accidents; there was an inherent logic to technical change governed by the law of minimisation of inputs or maximisation of output.

To what extent is Marglin dreaming - is there a history of other conceivable, alternative paths? There are now a number of studies of cases of technological change outside the locus of the factory system. Marglin himself cites the case of the Coventry ribbon weavers' cottage-factories.⁵¹ Landes admits to Pat Hudson's work on the artisan clothiers and co-operative company mills of the West Riding of Yorkshire.⁵² Charles Sabel and Jonathon Zeitlin have recently put together numerous other examples from various regions of Europe to claim the existence of another alternative path of industrialisation. Opposed to the rise of mass production, powered and factory based capitalism, they argue for a neglected history of highly innovative small scale capitalism based on flexible specialisation.⁵³ Sabel and Zeitlin ask us to imagine a world in which technology can develop in different ways - a world that might

have turned out different than it did - a world with a history of abandoned, but potentially viable alternatives to what actually exists. They cite a history of craft economies in a number of regions: silks in Lyons, ribbons, hardware and specialty steel in Saint-Etienne, edge tools, cutlery and speciality steels in Solingen, Remscheid and Sheffield, hardwares in Birmingham, calicoes in Alsace, woollens in Roubaix, cottons in Pawtucket, Rhode Island and textiles in Philadelphia. They also point out the invention and flexible use of highly productive technology suited to the artisan firm - the jacquard loom, the differential gear which allowed rapid change in yarns and weaves, and the techniques of the Birmingham trades - stamps, presses, drawbenches, electroplating and die sinking. These techniques could be adapted to steam power, and later to small electric motors. They were all good counter examples to Landes's reasons for the factory bias of technological change. But the craft economies ultimately failed - the victims of a clash of national variants of production in international competition leading to the abandonment of collective experiments in flexible production. Sabel and Zeitlin have, however, seen renewed possibilities for flexible specialisation in the opportunities opened up by micro-electronics technology and in the recent successes of areas like the Third Italy or Emilia-Romagna.⁵⁴

If we must beware of Landes's presentation of the success of capitalist hierarchy and the rise of the factory system as virtually a given, equally we must beware of the notion of other one-way systems. Sabel and Zeitlin's clear divide between mass production and flexible specialisation is open to serious objections of definition. The Japanese innovations of the 1960s demonstrated that assembly line

factories could be used more flexibly than they had in most Western countries, and that assembly industries created opportunities for connecting large, medium and small scale enterprises. Furthermore, while new computer controlled equipment could produce a greater variety of output, 'they do not restore an economic system based on redeployable productive resources and low fixed costs - that is a world we have lost'.⁵⁵

Sabel and Zeitlin's alternative is based on history, just as Landes's own critique. It is not the economeiries or dream economics he dismissed. But this history is just as questionable as the historical oppositions of Landes and Marglin. All of Sabel and Zeitlin's historical alternatives are open to other interpretations. The artisan clothiers of the Yorkshire woollen industry were successful for a long time, that is until the last quarter of the nineteenth century, but they were broken by changes in the market and competitive pressures in the industry, by the centralisation of finance and the disappearance of community and artisan values, which had previously fostered the self-exploitation of family labour.⁵⁶ The example of the innovative small scale sector in the Birmingham trades owes a great deal to historical myth about harmonious class relations, due to the face to face contact between employers and employees. But small firms in Birmingham were subordinated to large capital intensive firms at least from the first half of the nineteenth century. Even from the last half of the eighteenth century, the main directions of the trades were mapped out by coalitions and associations of large scale manufacturers. These big bosses were just as good, if not better, at using and developing the techniques of flexible

specialisation.⁵⁷ Sheffield's highly skilled independent artisans developed into the 'little masters' who proliferated and multiplied, not in times of prosperity, but in times of commercial stagnation and distress. Their lives were almost totally dictated to a local group of merchant capitalists.⁵⁸ Philadelphia's flexible and specialised textile industry was contained within both large scale and small scale manufacture, and its story was more fundamentally one of a great turnover of firms. Successful worker entrepreneurs coming in one each wave of immigration found their premises in the homes of former bankrupts. The handloom weavers there were no less a reserve army of labour than they were in England. The specialist factories had no less hazardous working conditions and were surrounded by no less squalid housing than were the mass production ones. And flexible shops as well as large scale firms in the carpet manufacture were centres of bitter strikes and class confrontation.⁵⁹ No doubt Sabel and Zeitlin's other cases are equally open to interpretation, and their historical alternatives' on this reading are not so great. Elsewhere Landes has written his own critique of Sabel and Zeitlin where he sums up:

'The economic advantages ... of flexible specialisation are ... creativity, nimbleness, easy entry. As a result, there will always be small firms, not only for what they offer the buying public, but for the services they can render big business ... On the other hand, these small firms have serious weaknesses. They lack the credit and resources of big units ... they are often obliged to operate on the margin ... which reminds us that small enterprise has its dark side as well as its bright: self-exploitation, inferior working conditions, personal dependence.'⁶⁰

Landes, to be sure, has sense on his side when he reminds us that small bosses are still bosses.

Conclusion

Finally, I see no reason why we should follow either Landes's technology led route to the factory system, or the Marglin - Sabel and Zeitlin notion of a conceivable, nonhierarchical flexible road. Industrialisation within the capitalist framework of eighteenth and nineteenth century Europe was a process of developing new techniques and new forms of work organisation. These included mechanisation, but also hand and intermediate techniques with the wider use of division of cheap labour. They included factory production, but also decentralisation, extended workshops and sweating. There was no necessary progression from one to another or along any single line of development - their relative efficiency depended on economic context, and almost any combination of them was possible.

The rise of the putting out system in seventeenth century Europe can be explained by the proclivity of capital to seek out cheap labour. The recent decentralisations of production processes evident in the new international division of labour aided by the new technology is equally a reaction to the barriers created in the centralisation of industry - notably the collective worker. Dispersal mystifies and complicates the capital-labour relation, weakening organised labour, and exploits a cheap labour force, especially women.

Rather than two roads to industrialisation, we might look on this phenomenon in terms of cycles of capitalist development. But more fundamental to our understanding of the origins of capitalist hierarchy was not the form of work organisation or the type of

technical change. Multiple alternatives and combinations of these were a permanent feature of industrial society. Priority must go back to understanding the context of accumulation, the limitations on it or the opportunities for bringing into play one or the other technical and work combination.

And this, in turn must bring us to Landes' last questions: 'where is Marglin coming from?' Landes identifies him with utopian aspirations and radical discontents of a long pedigree. Marglin is, furthermore, identified as an economic theorist, 'and to the theorist what is conceivable is possible'. He is a preacher to the true believers in a vision of what might have been. I would turn this last question around and ask instead where is Landes coming from. He presents himself as the historian - the man with the facts - the man whose job is to demythify the past and tell it like it was, and as one, who like historians generally, 'tends to be disenchanted by the record of human experience ... suspicious of promises'.⁶¹

But as Landes is well aware, historians too have a vision, though this is sometimes harder to identify among contemporaries than in our forebears. Landes's own teacher, A.P. Usher, from whom as he tells us he learned so much, framed his monumental An Introduction to the Industrial History of England in terms of a response to the rising tide of socialism just after the First World War. He opened his book with a critique of socialist economic history in particular that of the German Socialist, Rodbertus.⁶² And Landes's own vision in The Unbound Prometheus of the forward step of technological change was premised on his faith in what he marked out as the essential values of

European culture - 'the rational approach to problems combined with a Faustian will to mastery over things and nature, and the competition for wealth and power that grew with freedom of enterprise and private property'.⁶³ As every good historian knows, there are no free facts.

Marglin's original essay raised important questions about the relationship between technological and organisational change. But focussing as he did on the factory rather than the machine, on organisational instead of technological change, he failed to confront the 'autonomy' of technology. In seeing the division of labour only in terms of social hierarchy, he did not discuss the productivity gains to be achieved in manipulating gender, age and skill divisions across the labour force. In bypassing the machine and concentrating only on the disciplinary functions of the factory, he did not see the much more revolutionary control exerted through new mechanised technologies.

David Landes, for all his faith in the free market and the entrepreneur, has read his Smith and his Marx much more to the point. Capitalist production follows the path of profitability and surplus extraction. But this does not mean it is lead, as Landes also conveys, by the autonomous developments of technology. With hindsight, the division of labour and the machine entailed great gains in productivity. But such gains were not so clear cut at the time as he makes out. Their possibility could only be perceived and effected within a context of social and production relations. The machine was not an artifact, but a process of production which included all those changes in social relations within which it operated. The new

technologies of the Industrial Revolution were not developed by their own momentum, but by the context of distribution of capital and market power on the one hand, and regional social traditions, institutions and worker resistance on the other.

Footnotes

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